

# INTEGRATED CABLE CONNECTION AND SHIFTER HOUSING

## Cross Reference to Related Applications

This application claims the benefit of U.S. provisional Serial No. 60/463,489, filed April 17, 2003.

## Background of the Invention

Motion-transmitting remote control cable assemblies, sometimes referred to as “Bowden cables” or “push-pull cables”, are used for transmitting both force and motion along a curved path in aircraft, automotive, and marine environments. Known cable assemblies can be used for transmitting load and motion in both push and pull type applications. In the automotive environment, typical applications include but are not limited to parking brakes, accelerators, hood releases, brake releases, trunk releases, park lock, tilt wheel controls, fuel filler doors, transmission shifter cables, and hydraulic control cables. One specific use of such remote control cable assemblies is positioning transmission shift members in automobiles.

These cables include an inner core wire used to execute the actuation motion, and an outer case held stationary. The outer case typically includes a liner tube and a wire windings around the tube creating a strong case, which is then coated with nylon to provide an outer covering.

This invention concerns connectors for shift cables used to operate automatic transmissions, four wheel drive transfer cases, etc., by movement of a shift lever in the driver’s compartment. The shift lever is usually connected to various linkage components contained in a shifter housing including a base housing and a cover. Such connections must prevent moisture

1 from entering the housing and the transmission of sound and vibrations to the housing, as well as  
2 to establish a mechanical coupling of the operating cable thereto. Heretofore, a connector was  
3 separately assembled to the cable, and then the connector was assembled to the shifter base  
4 housing. This separate assembly necessitated a separate seal to the housing and a number of  
5 other manually installed components to couple the connector to the base housing in addition to  
6 the components necessary to isolate and seal the connector to the cable, which added components  
7 created significant labor and component costs.

8 It is the object of the present invention to provide a simplified integrated  
9 connection between the cable and the housing in order to lower the handling and assembly labor  
10 and the number of components required while still providing good performance in the field.

#### 11 12 Summary of the Invention

13 The above recited object and others which will be understood upon a reading of  
14 the following specification and claims are achieved by integrating a connector with a shifter  
15 housing, the connector comprised of simple snap together parts and structure integral with the  
16 base housing.

17 An elastomeric isolator enclosing one end of a metal sleeve is inserted into a  
18 generally cylindrical bore in the protrusion from the outside of the housing, abutted against  
19 shoulders form in the inside of the protrusion bore, the isolator is also formed with an integral  
20 partially spherical seat which is abutted against a ball end of the swivel tube.

21 A cap is installed in place over the end of the protrusion compressing the  
22 protruding end of the isolator, the cap having one or more wing features snap fit over an exterior

1 shoulder on the housing protrusion to capture and hold these components in position.

2 The isolator provides a moisture seal and sound vibration isolation between the  
3 housing and the connector and the cable to minimize the number of components, which also may  
4 be very quickly assembled to the housing base to connect and seal the cable thereto.

5 The isolator is assembled or overmolded onto the one end of the metal steel sleeve  
6 to enclose the same, a flanged tubular plastic insert also previously molded or assembled to the  
7 end of the steel sleeve, forming a single unitary piece.

8 The base housing is formed with an internal tubular protrusion configured to  
9 receive a swivel tube inserted from outside the housing, the swivel tube having a ball end which  
10 comes to rest in a partially spherical seat molded into the protrusion when the swivel tube is  
11 inserted into a concentric hole aligned with the seat, the hole allowing the body of the swivel  
12 tube to pass into the interior of the base housing.

13 The metal sleeve is crimped to an operator cable case, while the cable core wire  
14 passes through the sleeve, through a guide opening in the plastic tube insert, and thence through a  
15 hole in the partially spherical seat in the isolator which holds the ball end of the swivel against  
16 the partially spherical seat molded into the housing protrusion. The cable core wire also extends  
17 through the swivel tube and is fixed to one end of a rod to be connected to linkage components  
18 driven by a shift lever, which rod is slidably received in the other end of the swivel tube.

## 19 20 Description of the Drawings

21 Figure 1 is a pictorial view of an operator cable and base housing assembly.

22 Figure 2 is an enlarged fragmentary view in partial section of the base housing and

1 cable connector components of the assembly shown in Figure 1.

2 Figure 3 is an enlarged fragmentary exterior view of the base housing and a  
3 portion of the operator cable.

4 Figure 4 is an enlarged fragmentary view from the interior of the base housing  
5 showing one end of the swivel tube and operating rod.

6 Figure 5 is a further enlarged partially sectional view of the cable connector  
7 components and a protrusion portion of the base housing.

8 Figure 6 is an enlarged partially sectional view of the base housing protrusion  
9 with a nonsectional view of the isolator, swivel tube and steel sleeve components.

10 Figure 7 is a further enlarged partially sectional view of the components shown in  
11 Figure 6 but with the isolator shown in complete section.

#### 12 13 Detailed Description

14 In the following detailed description, certain specific terminology will be  
15 employed for the sake of clarity and a particular embodiment described in accordance with the  
16 requirements of 35 USC 112, but it is to be understood that the same is not intended to be  
17 limiting and should not be so construed inasmuch as the invention is capable of taking many  
18 forms and variations within the scope of the appended claims.

19 Referring to the drawings and particularly Figure 1, a cable shifter housing  
20 assembly 10 includes an operator cable 12 and base housing member 14. The cable 12 has a  
21 fitting assembly 16 for connection to a vehicle drive unit to be controlled (not shown), including  
22 an end piece 18 received on a control element of the unit to be controlled. The cable 12 includes

1 an outer case 20 and a core wire 22 which moves within the case 20 to carry out the actuating  
2 movement required to operate the controlled unit, in the well known manner.

3 The cable 12 is secured to the base housing 14 by an integrated connector-isolator  
4 assembly 24 fit within a generally cylindrical opening 56 (Figure 5) over a protrusion 26 of the  
5 base housing 14. The base housing 14 is installed in the vehicle passenger compartment and  
6 houses a steel shift rod 28 having an eye 30 at its free end to be able to be connected to various  
7 linkage components (not shown) enclosed within the base housing 14 and moved by a control  
8 lever (also not shown) accessible in the passenger compartment so that the driver can operate the  
9 controlled unit. A cover (not shown) would normally overlie the interior of the base housing 14,  
10 secured to housing flange 32.

11 Figure 2 shows further details of the integrated connector isolator assembly 24.

12 The base housing 14 which may be constructed of a suitable molded structural  
13 plastic, such as a glass filled nylon, includes the generally cylindrical protrusion 26 which  
14 functions as an integrated cable connector housing.

15 An inner projecting tube portion 34 has a partially spherical seat 38 concentric to  
16 a central bore through which the body 42 of a plastic swivel tube 40 passes in extending into the  
17 interior space 44 of the base housing 14. A reduced diameter land 43 of the body 42 is provided  
18 to increase clearance with a flared wall 39 and to increase the spherical area of the ball head 48  
19 of the swivel tube 40. The partially spherical seat 38 engages the generally spherical ball head 48  
20 of the swivel tube 40 integral with the body 42 to prevent movement of the swivel tube 40 into  
21 the interior space 44 of the basing housing 14 while allowing a limited tilting of the rod 28 which  
22 is slidably fit therein to accommodate the lengthwise movement induced by movement of the

connected linkage components.

A flared wall 39 around the seat 38 accommodates the tilting of the swivel rod 40 to increase the extent of tilting possible.

The cable core wire 22 passes through an opening 46 in the swivel tube 40 with a generous clearance to avoid contact therewith, and the end extends into a hole in the end of the rod 28, in which it is fixedly connected as by a crimping or staking at the inserted end of the rod 28.

The swivel tube 40 provides lateral support for the rod 28 as it undergoes telescoping sliding movement therein and limited tilting caused by operation of the linkage components (not shown).

A metal sleeve 50 has an isolator 52 assembled over one end of the sleeve 50 to enclose the same. A plastic flanged tubular insert 54, is molded or assembled to the same one end of the sleeve 50 lining the inside of the one end of the sleeve 50. The one end of the sleeve 50 is inserted into a generally cylindrical opening 56 of the housing protrusion 26 after the addition of the isolator 52 and insert 54. The generally cylindrical opening 56 has two steps or shoulders 58, 60 and a tapered shoulder 62 molded therein against which are abutted corresponding features on the isolator 52.

The isolator 52 may be molded in two or more transverse sectional parts to enable easy assembly over the flanges on the sleeve 50 and insert 54. Alternatively, the isolator 52 may be overmolded to the one end of the sleeve 50.

The metal sleeve 50 is typically made of steel and has an intermediate flange 64 which acts to transmit the thrust exerted by the outer casing 20 when the cable 12 is operated into

1 the isolator 52. The flange on the plastic tubular insert 54 also assists in this.

2 The isolator 52 is designed to absorb any sound or vibrations transmitted along  
3 the cable 12 to prevent these from reaching the base housing 14 in the known manner, and also  
4 acts as a seal, and thus is constructed of a resilient material such as polyurethane, rubber, silicone  
5 rubber or similar materials. A hardness on the order of Shore A 50-60 is desirable to provide  
6 sufficient stiffness to hold the case 20 of the cable 12 while elastic enough to seal to the sleeve  
7 50 and housing 14 and to absorb any sound or vibrations.

8 The sleeve 50 is secured to the case 20 of the cable 12 as by hex crimping the  
9 ribbed end 66 to the case 20 in the known manner as depicted in Figure 6. A flange 49 on the  
10 sleeve 50 acts as a stop to locate the cable case 20 endwise when inserted therein prior to  
11 crimping.

12 The isolator 52 is formed with a partially spherical seat 68 which captures the ball  
13 end 48 of the swivel tube 40, by abutting the same when the isolator 52 is inserted into the  
14 opening 56.

15 The isolator 52 and metal sleeve 50 are inserted from the left as viewed in the  
16 drawings into the opening 56. The end face 70 of the isolator 52 projects slightly past the end 27  
17 of the housing protrusion (Figure 7). A snap cap 72 is then advanced onto a reduced diameter  
18 section 53 (Figure 7) of the isolator 52 to compress the same slightly until wings 74 snap over a  
19 sloping ridge 76 to catch on the perpendicular rear face thereof. This secures the assemblage of  
20 these parts together.

1           The isolator 52 acts as a seal against both the housing 14 and sleeve 50, as well as  
2 a sound/vibration isolator preventing transmission of sound or vibrations between the sleeve 50  
3 and housing 14.

4           The snap cap 72 is constructed of a molded plastic such as unfilled nylon to be  
5 strong enough to hold the parts together yet able to be deflected to be snap fit over the ridge 76.

6           Accordingly, the cable 12 and base housing 14 form a single assembly, reducing  
7 the possibility of dislodgement, loosening or moisture leakage into the housing 14 while  
8 eliminating extra seals and other components necessary if the cable and connector 24 were  
9 assembled together separately from the housing 14.

10          The isolator 52 end portion 53 protrudes through the hole 73 in the snap cap 72 to  
11 insure that no direct contact with the metal sleeve 50 occurs, assuring complete isolation between  
12 the sleeve 50 and housing 14 to prevent transmission of sound and vibration thereto.

13          The plastic insert 54 has an aligned passage 55 which acts as a guide for the cable  
14 wire core 22, without causing undue wear as the wire core 22 is shifted back and forth to operate  
15 the transmission. There is sufficient clearance within the swivel tube 40 to insure minimal  
16 contact therewith to minimize wear.

17          To assemble the components, the swivel tube 40 is inserted into the housing  
18 through the bore 56 of the housing protrusion 26, the ball end 48 resting on the seat 38. The  
19 sleeve-isolator assemblage is then inserted into bore 56 and the cap 72 installed by snap fitting  
20 onto the protrusion 26.

21          The cable 12 is then inserted to abut the case 20 against the flange 49, with the  
22 wire core 22 then advanced through the sleeve 50, insert 54 through the swivel tube 40, and the



1 end thereof inserted into a hole in one end of the steel rod 28. The cable wire core 22 crimped or  
2 staked thereto or otherwise fixedly attached to the rod 28. The steel rod 20 is slid into the swivel  
3 tube 40 as the wire core 22 is retracted, the cable case 20 thereafter crimped to the steel sleeve  
4 50.